

## **APPENDIX C. MEASURES TO MITIGATE UNAVOIDABLE ADVERSE IMPACTS**

Chapter 4 identified potential adverse impacts of program technologies along with mitigation measures and BMPs that could be implemented to either avoid or minimize these effects. A summary of unavoidable adverse impacts to each resource and methods to mitigate their effects are discussed herein.

### **C.1 ATMOSPHERIC RESOURCES**

- Operation of trucks, compressor engines, pumps, and heating units to convey and inject CO<sub>2</sub> into geologic formations would release both criteria pollutants and CO<sub>2</sub>. Emissions from compressors, pumps, and heaters could be mitigated by using BACTs or by connecting them to electric utilities whenever feasible.
- Locate CO<sub>2</sub> pipelines and injection areas away from populated areas and environmentally sensitive areas.
- Localized generation of fugitive dust and particulate emissions would result from land clearing and construction activities. These emissions can be minimized through BMPs discussed in Section 4.2.
- Accidental releases of H<sub>2</sub>S from co-sequestration projects could cause localized releases of toxic air pollutants and result in objectionable odors. Accidental releases of H<sub>2</sub>S could be avoided or minimized through inspection and monitoring of system components.

### **C.2 GEOLOGIC RESOURCES**

- The addition of CO<sub>2</sub> to the water-bearing oil reservoir rocks can decrease the water pH and alter the Eh of the formation water, which may mobilize trace elements (e.g., arsenic, selenium, lead), depending on the site-specific geochemical factors. Careful site selection, detailed hydrogeologic characterization, proper construction and operation of facilities, and implementation of BMPs would help preserve both the quality and quantity of groundwater in the area of the sequestration process.
- For co-sequestration projects, H<sub>2</sub>S is a strong corrosive agent and could likely cause an increased risk of well casing leaks. In the event of casing leakage into a shallow potable aquifer, the H<sub>2</sub>S may cause the groundwater to become more acidic and thus have the potential to mobilize higher concentrations of trace metals in the aquifer. Careful site selection, detailed hydrogeologic characterization, proper planning, and implementation of BMPs would help avoid or mitigate potential impacts to the geologic resources of an area due to the sequestration process.
- Long-term adverse impacts could result from the inadvertent leakage of CO<sub>2</sub>, H<sub>2</sub>S, other formation fluids, and/or metals into overlying potable water aquifers.

### **C.3 SURFACE WATER RESOURCES**

- Land disturbance during construction activities could result in sedimentation of water bodies due to storm water runoff. These construction activities would comply with state or local soil conservation permit requirements and best management practices to reduce sedimentation of nearby water bodies.
- CBM recovery or EOR may produce a large quantity of process water with elevated dissolved solids and high salinity. Discharge of poor quality water to surface water supplies would cause degradation of the receiving body of surface water. To avoid such impacts, process water that

exceeds CWA standards or local surface water regulations would be treated to meet such standards, or reinjected into permitted UIC wells (deep saline aquifers) where available.

## **C.4 BIOLOGICAL RESOURCES**

- Construction of a CO<sub>2</sub> pipelines could result in localized, temporary destruction of habitat. Standard construction techniques and BMPs would be used to minimize impacts to biological resources. Pipelines would be sited to avoid wetlands and other environmentally sensitive areas, and minimize crossing of streams. Existing rights-of-way would be used whenever possible.
- Construction and operation of surface facilities and pipelines would have the potential for adversely impacting biota in streams and wetlands. The potential impacts could be minimized by proper siting of facilities, and avoiding wetlands and streams. If wetlands and streams could not be avoided, the implementation of BMPs would help minimize adverse impacts.
- If the project was developed in the vicinity of surface water resources or wetlands, there would be a potential for adverse impacts on these resources. The adverse impacts could include impaired water quality caused by increased erosion and runoff from the site that introduces contaminants to the water body or wetland. The implementation of BMPs would help minimize adverse impacts.
- Wetlands and aquatic resources could be affected by site maintenance activities that involve mowing or cutting of wetland and riparian vegetation. The loss of vegetation could result in decreased water quality due to increased surface runoff from the site. The implementation of BMPs would help minimize adverse impacts.

## **C.5 CULTURAL RESOURCES**

- New easements or rights-of-way may be necessary for construction of pipelines, resulting in potential impacts to archaeological and/or American Indian resources. Where practicable, impacts on these resources would be minimized by co-utilizing easements of other utility pipelines and power transmission lines.
- Construction of surface facilities, access roads, and pipelines would have the potential to cause minor adverse impacts to archaeological and Native American resources. This potential is greater if facilities must be sited near surface water features. Compliance with the applicable regulations and requirements would limit the likelihood of construction occurring in or impacting cultural resources.

## **C.6 AESTHETIC AND SCENIC RESOURCES**

- Clearing ROWs during construction and maintenance of ROWs and surface facilities could result in minor or moderate adverse impacts on aesthetic and scenic resources, depending upon the existing characteristics of the proposed corridor.
- Construction activities, including clearing the site and exhaust emissions, fugitive dust, and noise from construction equipment could result in minor short-term adverse impacts to aesthetic and scenic resources.
- Long-term aesthetic impacts from operations would be negligible to minor and could be minimized by siting surface facilities away from important scenic and natural areas.

## **C.7 LAND USE**

- The potential need for easements and rights-of-way for underground CO<sub>2</sub> pipelines and access roads would potentially cause adverse impacts to the existing land use. Where practicable,

impacts on land use can be minimized by utilizing easements already established for other utility pipelines and power transmission lines.

- The relatively small site footprints required for surface facilities associated with a coal seam, EOR, or saline aquifer sequestration project have a potential to cause minor impacts on land uses. Aboveground uses in the majority of lands needed for sequestration projects generally would not be altered. Potential impacts to land use would be minimized by avoiding areas of restricted land use when siting the surface facilities.

## **C.8 MATERIALS AND WASTE MANAGEMENT**

- Chemical processes for capturing CO<sub>2</sub> would result in the generation of hazardous waste. Impacts associated with waste disposal would be minimized by disposing of wastes at approved, permitted facilities in accordance with all applicable laws and regulations.
- Co-sequestration technologies would result in additional disposal options for H<sub>2</sub>S from power generation, industrial, and mineral extraction processes. Impacts associated with geologic sequestration of H<sub>2</sub>S would be minimized through the permitting process.

## **C.9 HUMAN HEALTH AND SAFETY**

- The program would require construction and operational jobs that may result in additional worker injuries. These injuries could be avoided or minimized through proper planning, job training, and daily safety protocols.

## **C.10 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE**

- Minor adverse impacts to socioeconomics would occur if the program required new facilities or a significant expansion of the existing facility property or would otherwise introduce features (increased air emissions, noise, hazardous materials, etc.) that would adversely affect adjacent housing, businesses, and/or community services. Avoiding locations that may cause displacement of population, residential housing, or local businesses would minimize these potential impacts. Locations that may adversely affect the range and capacity of community services (fire, emergency response, law enforcement, etc.) may also be avoided.